# Questions and Answers

This page contains the answers to some questions about the Former Memphis Depot site and the ongoing environmental restoration program. It has been divided into four areas: **General**, **Community Involvement**, **Health and Safety** and **Cleanup Remedies**.

If you have a question that is not answered here, please call the Memphis Depot Community Relations Office at (901) 774-3683. More information on the Depot's environmental restoration program can be found in the Depot's Information Repositories and online in our Administrative Record. To access the AR, go to **http://www.adminrec.com/DLA.asp** and click on the link for Memphis.

## General:

**What is the history of the Memphis Depot?**
Activated in 1941 as a supply depot, the U.S. Army operated the Memphis Depot until 1963 when the Defense Logistics Agency (DLA) took over and operated the facility until it closed in September 1997. The Memphis Depot received, warehoused, and distributed supplies common to all U.S. military services and some civil agencies. Stocked items included food, clothing, petroleum products, construction materials, and industrial, medical, and general supplies.

The Memphis Depot covers 642 acres and consists of two areas – the Main Installation, 574 acres, and Dunn Field, 68 acres. Activities conducted at the Main Installation include pesticide storage and application, vehicle and equipment maintenance, and hazardous material storage and handling. Dunn Field was primarily used to store bauxite and fluorspar for the Defense National Stockpile Center. Disposal activities at Dunn Field began in 1946, with the decontamination and burial of 29 mustard-filled German bomb casings, and continued periodically until the late 1960s.

**What is the source of the environmental issues at the Depot?**
Prior to the 1960s and 1970s, when people became aware of the environmental impact of waste disposal, it was a common practice to bury garbage and waste materials in the ground. Environmental regulations came into effect, and the Department of Defense began identifying areas at their bases that may require environmental cleanup. In 1981, an environmental assessment identified areas of soil and groundwater at the Memphis Depot that may require cleanup. We have been working since then to fully define the extent of the areas, determine the most effective cleanup methods in consultation with regulators and the community, and implement the cleanup process.

**When did the environmental cleanup program begin?**
An environmental restoration program has been in place at the Memphis Depot since the 1981 Installation Assessment. Since then the Memphis Depot has completed several additional environmental investigations including an initial Remedial Investigation (RI) in 1989 and 1990.

In 1992, USEPA placed the Memphis Depot on the National Priorities List for environmental cleanup. In 1995, DLA entered into a Federal Facilities Agreement with USEPA and TDEC that outlined the environmental cleanup process for the Memphis Depot. Also in 1995, the Memphis Depot was placed on the list of Department of Defense (DoD) facilities to be closed under Base Realignment and Closure (BRAC). Additional RI fieldwork began in 1998 to more completely define the extent of the affected soil and groundwater.

**What remedies have been selected to cleanup the Depot?**

The selected groundwater and surface soil remedies for the Main Installation include:

- Excavation, transportation, and off-site disposal at a permitted landfill of an estimated 7,200 $ft^2$ of surface soil containing lead concentrations equal to or greater than 1,536 milligrams per kilogram (mg/kg) near the southeast corner of Building 949. The Memphis Depot completed a removal action at this area in August 2001, so this portion of the remedy is completed.
- Deed restrictions and site controls, which include the following:
  - Prevention of residential land use on the Main Installation (except at the existing Housing Area).
  - Daycare restriction controls.
  - Production/consumptive use groundwater controls for the fluvial aquifer and for drilling into aquifers below the fluvial aquifer on the Main Installation.
  - Elimination of casual access by adjacent off-site residents through maintenance of a boundary fence surrounding the Golf Course.
- Enhanced bioremediation of chlorinated volatile organic compounds (CVOCs) in the most contaminated part of the groundwater plume.
- Long-term groundwater monitoring to document changes in plume concentrations and to detect potential plume migration to off-site areas or into deeper aquifers.
- 5-year reviews of the selected alternatives.

The land use controls (deed restrictions and site controls) that are included as part of the selected remedy provide additional layers of protection above the existing land use and groundwater controls as established by the: (1) City of Memphis and Shelby County zoning regulations; (2) Federal Property Management Regulations; and (3) Ground Water Quality Control Board for Memphis-Shelby County Health Department.

The selected remedy for Dunn Field includes:

- Excavation, transport, and disposal of soil and material contained within disposal sites located in the western half of Dunn Field based upon results from a pre-design investigation into these sites. According to the Dunn Field Disposal Sites Remedial Design, Sites 3, 4.1, 10, 13 and 31 will undergo excavation, transport and disposal.
- Use of soil vapor extraction (SVE) to reduce VOC concentrations in subsurface soils to levels that are protective of the intended land use and groundwater.

- Injection of zero-valent iron (ZVI) within Dunn Field to treat chlorinated volatile organic compounds (CVOCs) in the most contaminated part of the groundwater plume.
- Installation of a permeable reactive barrier (PRB) to remediate CVOCs within the off-site area of the groundwater plume (west of Dunn Field).
- Monitored natural attenuation (MNA) and long-term groundwater monitoring (LTM) to document changes in plume concentrations, to detect potential plume migration to offsite areas or into deeper aquifers, and to track progress toward remediation goals.
- Implementation of land use controls, which consist of the following institutional controls: deed and/or lease restrictions; Notice of Land Use Restrictions; City of Memphis and Shelby County zoning restrictions and the Memphis-Shelby County Health Department groundwater well restrictions.

**What is progress of the cleanup at the Memphis Depot site?**
The environmental cleanup program at the former Memphis Depot is now in the final stages of the six-stage process outlined in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). These stages are: Remedial Investigation, Feasibility Study, Proposed Plan, Record of Decision, Remedial Design and Remedial Action.

The Depot completed the Main Installation Remedial Investigation (RI), Feasibility Studies (FS) and Proposed Plan (PP) for Soil and Groundwater in 2000. The Dunn Field RI was completed in 2002 followed by the Dunn Field FS and PP in 2003. The Main Installation Record of Decision was signed in 2001 and the Dunn Field Record of Decision was signed in 2004. The Records of Decision outline the cleanup solutions that will be implemented to address environmental conditions and ensure the sites are safe for future reuse.

The Remedial Designs for the Main Installation and the Dunn Field Disposal Sites have been completed, and Remedial Action (RA) is now underway at the disposal sites. RA at the Main Installation is expected to begin in late 2005. In 2006, we will move forward with the next phase of the approved groundwater treatment on Dunn Field and that will continue through 2007. Based on our current schedule we plan to have all of the Depot property approved for transfer to the community by 2010.
These dates are based on current information and may be subject to change.

The Depot's environmental team will keep the community informed of the progress on the cleanup program through our regular community outreach activities such as public briefings, community information sessions, Restoration Advisory Board meetings, media releases, fact sheets and future issues of EnviroNews.

For more information, please contact the Community Relations Office at (901) 774-3683.

**What is the level of cleanup proposed for the Depot?**

For the majority of the Depot, the level of cleanup will make it suitable for industrial reuse. The former Family Housing Area is suitable for residential reuse. The Golf Course area is currently suitable for recreational reuse. The eastern half of Dunn Field is available for unrestricted reuse, consistent with property transfer and zoning requirements.

The cleanup levels for the Depot are established by the Base Realignment and Closure (BRAC) Cleanup Team, based on the intended reuse of the site. They have been developed in accordance with USEPA and TDEC regulations. These cleanup levels will meet strict standards for the protection of human health and the environment.

More information on cleanup goals can be found in the Records of Decision for the Main Installation and Dunn Field, which are available for review in the Depot's Information Repositories, or online in the Administrative Record (AR). Go to **http://www.adminrec.com/DLA.asp** and click on the Memphis tab.

**Why is it taking so long to clean up this site?**
There is a lengthy process of investigating environmental conditions, determining cleanup levels, and developing and implementing cleanup plans under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

Following a thorough records search to identify locations with the potential for hazardous substances, we conducted sampling and analysis to verify the presence and nature of suspected compounds as well as to define the area affected by the suspected compounds. All of that information was used to determine what level of cleanup was required as well as the most effective cleanup remedy. Of the four remedial designs to be prepared for the former Depot, two have been completed and two are being prepared. Implementation of one remedial design (Excavation, Transportation & Disposal) has begun and a second (Enhanced Bioremediation Treatment) is to begin later in 2005.

**When will clean up be complete?**
All remedies are scheduled to be in place in 2008. It will take approximately 10 to 15 years for the remedies to clean up groundwater to the remedial action objectives – Safe Drinking Water Act standards.

**What is the cost of the clean-up?**
From 2003 through project completion, environmental restoration costs are estimated to be approximately $26.2 million dollars.

**Who is paying for the clean-up?**
The Department of Defense, through the Defense Logistics Agency and the Defense Distribution Center, pays for the cleanup at the Depot. Funds come from the DoD Base Realignment and Closure Account.

**Could the environmental cleanup actions at the Depot require the relocation of residents?**

No. The environmental conditions and the cleanup activities at the Depot will not require this type of disruption to the community.

**What is Chemical Warfare Materiel, and why was it under the ground in Dunn Field?**
Between 1942 and 1953, the Depot stored and distributed protective compounds and other materials including Chemical Agent Identification Sets (CAIS), which contained very small amounts of chemical agents and were used to train military personnel in identifying those chemical agents.

When these items became outdated, they were buried underground, which was the common disposal method at the time. Also, in 1946, 29 captured German mustard bomb casings on a train passing through Memphis on its way to Pine Bluff Arsenal in Arkansas were discovered to be leaking. The casings were removed from the train, safely disarmed and drained into a pit on Dunn Field containing a substance that neutralized the mustard, and were then buried in the ground at Dunn Field. The removal and safe disposal of the casings and the pit used to neutralize the drained mustard was completed in 2001.

**Is there a possibility you might find more Chemical Warfare Materiel while you're working on Dunn Field?**
We do not expect to find any additional CWM material. In 2001, the environmental team completed an early removal action for chemical warfare materiel (CWM) at Dunn Field. During that project, we removed all CWM related materials that were identified in the historical records at the former Memphis Depot. In addition, we conducted a Pre-Design Investigation at the former disposal area on Dunn Field. Based on those two investigations, we do not expect to find any additional CWM material.

Our field crews are trained to identify the nature of the waste that is discovered throughout the cleanup process. A site safety plan will be completed and approved by the USEPA and TDEC as part of the Remedial Action work plan, and our environmental contractors will take all appropriate safety precautions to protect the community.

**What controls are in place to minimize dust while working on Dunn Field?**
Throughout the process, our contractors follow best environmental practices outlined in the Site Safety Plan to minimize dust during the removal action. These include wetting dry areas and covering excavated soil piles.

# COMMUNITY INVOLVEMENT

**How will the community be involved and informed during the cleanup?**
We are committed to keeping the community informed of all cleanup activities at the Depot and responding to your questions, concerns and suggestions during the process.

We conduct periodic Restoration Advisory Board (RAB) meetings that are open to the public and provide valuable information about the cleanup project, as well as opportunities to express any concerns and suggestions. Meetings are currently held twice

a year as activities warrant. We also host Community Information Sessions and Public Briefings to provide timely information about cleanup activities. All public meetings are advertised in local media and on the Depot's website.

The Depot also distributes fact sheets, bulletins, and a community newsletter, EnviroNews, which contains up-to-date information on the cleanup project. If you would like more information on community involvement opportunities during the cleanup program, please contact the Community Relations Office at (901) 774-3638.

**Is the Depot open for public tours?**
The Depot closed September 30, 1997. We have limited staff and no longer provide tours. However, the public is invited to contact the Community Relations Office to arrange an appointment to visit the Community Outreach Room at the Depot. This on-site Information Repository contains historical information, scientific reports and a wide range of resources related to the Depot and the cleanup activities. For more information or to make an appointment, phone (901) 774-3638.

**How can the community provide input to the future use of the Depot property?**
The Depot Redevelopment Corporation (DRC) has established a board comprised of community leaders and local business people to determine effective economic reuse of the Depot that will meet the needs of the community. The DRC is operated by the City of Memphis under the direction of Jim Covington. For more information on your questions concerning development and reuse of the Memphis Depot, you can call the DRC at (901) 942-4939.

**I live in the community and have questions about some of the technology you will be using on the site. Will the community be notified before these technologies are implemented?**
Yes. The environmental cleanup program at the Depot is being conducted according to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which includes specific guidelines for community involvement, including opportunities for public review and comment. The Depot's Community Relations Office has met all of these guidelines, and implemented additional opportunities over and above the guidelines to provide information and seek public input as part of our comprehensive Community Involvement Plan (CIP).

The selected remedies were presented in the Proposed Plans for the Main Installation and for Dunn Field and were presented for public comment at official Public Comment Meetings as part of the CERCLA process. Implementation of the cleanup remedies is described in the Remedial Designs (RD). A Public Briefing is held for each RD prior to beginning that phase of remedial action.

In addition, regular fact sheets and articles in our community newsletter, EnviroNews, are sent to our mailing list of more than 4,700 addresses, and information about each stage of the cleanup program is presented and discussed at the Depot's Restoration Advisory

Board (RAB) meetings. These meetings are open to the public and advertised in community newspapers.

If you would like more information on our cleanup program, or would like to be added to our mailing list, please contact the Depot's Community Relations Office at (901) 774-3683.

# HEALTH AND SAFETY:

**Is anyone being exposed to the solvents in the groundwater?**
No. The solvents in the ground water are in the shallow aquifer, which is not a source of drinking water for the City of Memphis. The shallow aquifer groundwater is restricted from use as a drinking water source by the Memphis-Shelby County Health Department. This restriction applies to all of Shelby County.

**Is the drinking water safe?**
Yes, the drinking water is safe. The affected groundwater is in the shallow aquifer, which is not used for drinking. The drinking water in Memphis comes from the Memphis Sand aquifer, which has not been affected by historic activities at the former Memphis Depot. In the Record of Decision, we have identified areas within the shallow aquifer that require cleanup to reduce the potential risks of exposure and to meet the cleanup objectives outlined in the Record of Decision. We are now in the process of designing and implementing the technologies that will reduce or eliminate these chlorinated solvents from the groundwater, and ensure the future safety of this site for the intended re-use.

**Are there health hazards from the Depot to residents in the area?**
No impact to human health of residents in the area has been indicated. Several public health assessments have been completed for the Memphis Depot, the latest in 2000. The assessments indicated no impact to human health of residents in the area. There is no public access to areas on the site where the environmental conditions exceed the cleanup standards. The City's drinking water comes from a deep aquifer, which is about 300 feet below the ground surface and our investigation indicates it has not been affected. The groundwater being treated at the Depot is from the shallow aquifer, which is about 80 feet below the ground surface.

**Does CWM pose a risk to the health and safety of the community?**
No. The CWM removal action was completed in 2001. All CWM materials were excavated and removed from the site and do not pose a risk to the community.

The Army Corps of Engineers, the Edgewood Chemical Biological Center and the contractors have many years of experience removing these materials. The removal action was contained within a state-of-the-art, sealed structure with complete air filtration and monitoring as part of a comprehensive Site Safety Submission prepared by the Corps. This document detailed the steps that were taken to safely remove CWM materials, while ensuring the safety of the surrounding neighbors during the cleanup.

**Are actions at the Depot affecting cancer rates within the local community?**
At this time, we have no scientific evidence of a direct correlation between cancer rates and past activities at the Depot. The Memphis Depot works closely with the Agency for Toxic Substances and Disease Registry (ATSDR) and the Memphis- Shelby County Health Department in an effort to identify health concerns that may be related to environmental conditions. In December 1999, ATSDR released an updated draft Public Health Assessment. ATSDR is the agency responsible for responding to public health questions, and works in association with the local Health Department to provide appropriate health education and assistance to the community.

**I worked at the Depot. Could the chemicals I was exposed to in my job make me sick?**
If you believe you have a job-related illness, please contact the Department of Labor or any active federal facility to request a CA-1 form. You must obtain assistance from your physician in completing the form. The Department of Labor will review the form and advise you what to do.

**Was there a release of mustard agent at Dunn Field during the CWM removal?**
No. Air monitoring and soil sampling results have confirmed that mustard agent was not detected, nor was it present inside the vapor containment structure (VCS).

**Why were three workers at Dunn Field sent to the hospital during the CWM removal?**
Three employees of the CWM contractor, UXB International Inc., had been working inside the VCS for approximately one hour, performing soil removal work on a 500-kg empty bomb casing which was being removed from Site #24-A. They were dressed in Level D protective clothing, which included a facemask respirator with a High Efficiency Particulate Air filter, in accordance with the Site Safety Plan. After leaving the VCS, the workers said they noticed a strange odor during the excavation. They also reported feelings of nausea, headache, dizziness and sinus irritation. They were supplied with oxygen and observed by the on-site medical team for 30 minutes. Their symptoms subsided but did not completely disappear. The incident was reported to the on-site Safety Specialist, who directed the workers to be examined by a qualified physician at the Regional Medical Center in Memphis.

The monitoring equipment inside the VCS used the most advanced technology to detect chemical warfare materiel in the air and soil. The results of all samples collected before and after the incident confirm that no mustard agent was present at the site. The soil contained low levels of two breakdown by-products of sulfur mustard, known as thioxane and dithiane. These by-products were produced during the decontamination process when the mustard agent was combined with a bleach mixture to neutralize the agent prior to being buried in 1946

The physicians at the Regional Medical Center conducted a full examination of the three workers, including blood tests. The examination revealed no evidence of exposure to

mustard or to related chemicals. However, based on the symptoms listed on the material safety data sheet for dithiane, the CWM physician's at the Regional Medical Center believe dithiane could have caused the workers' symptoms.

# CLEANUP REMEDIES

## ZERO-VALENT IRON (ZVI)

**What is Zero-Valent Iron?**
Zero-Valent Iron (ZVI) is one of the remedial technologies selected to clean up solvents in the groundwater on the western side of Dunn Field. ZVI has been used to treat solvents in the groundwater in a treatability study on Dunn Field and in an early implementation on Memphis, Light, Gas and Water (MLGW) property northwest of Dunn Field.

**How does it work?**
ZVI is a natural material similar to iron filings or powder. It acts as a catalyst to breakdown the chemicals in groundwater – such as the solvents known as chlorinated volatile organic compounds (CVOCs) that are present in the groundwater at the Depot – into safe compounds. This chemical reaction is called reductive dechlorination.

**Will the reaction of the iron with the solvents cause the formation of any other chemicals?**
A pilot study that was completed at the Depot in April 2004 showed that Zero Valent Iron (ZVI) injection effectively reduced solvents in the groundwater by an average of 95 per cent. The formation of other chemicals, known as byproducts, did not occur.

Once ZVI injection has been completed, groundwater monitoring will be implemented to determine the effectiveness of the remedy, and ensure environmental conditions meet the cleanup objectives defined in the Record of Decision (ROD) for Dunn Field for safe industrial and recreational reuse.

The ROD provides a complete analysis of the remedies chosen for Dunn Field. Each remedy and technology was thoroughly evaluated for safety and efficacy – including the potential for reactivity or the creation of undesirable breakdown products – and has been approved by USEPA and TDEC.

**What happens if the iron comes in contact with other chemicals other than CVOCs?**
No adverse reactions are expected from use of ZVI during the planned remedial actions. ZVI was selected on the basis of its effectiveness in treating the primary groundwater contaminants at the former Depot. No adverse reactions to other chemicals present at low concentrations were observed during the ZVI field study at Dunn Field or the early remedy implementation on MLGW property west of Dunn Field.

Each remedy and technology being used at the Depot has been thoroughly evaluated for safety and effectiveness, including the potential for reactivity or the creation of undesirable breakdown products, and has been approved by USEPA and TDEC. In

addition, pilot studies have been conducted to ensure these remedies will be safe and effective under the environmental conditions at the Depot. The Record of Decision (ROD) for Dunn Field provides a complete analysis of the remedies chosen for Dunn Field.

**How do we know this treatment is safe?**
Iron is a naturally-occurring element that is essential for health. ZVI is a food-grade, powdered iron product that has been used to treat groundwater impacted by CVOCs since the early 1990s. USEPA considers it to be a safe substance that presents no unacceptable risks to human health or the environment.

The Record of Decision (ROD) for Dunn Field provided a complete analysis of the remedies chosen for the Depot, including a review of their performance at other cleanup sites. Each remedy was thoroughly evaluated for safety and efficacy and has been approved by USEPA and TDEC. In addition, pilot studies have been conducted to ensure these remedies will be safe and effective under the environmental conditions at the Depot.

**Why did you decide to use this technology at the Depot?**
ZVI is recognized by USEPA as a cost-effective and reliable technology to treat groundwater impacted by chemicals such as the solvents known as volatile organic compounds (VOCs) in the groundwater at the Depot. At many sites, the use of ZVI is replacing the more traditional pump and treat systems as the preferred method for addressing environmental conditions in groundwater.

The Dunn Field Record of Decision (ROD) provides the justification for the preferred cleanup remedies chosen at the Depot. Each remedy was selected to ensure the site meets health protective standards for the designated future reuse. ZVI was selected, in part, because it provides effective treatment of a wide range of groundwater contaminants including the primary compounds present at the Depot

**How do you know this technology will work here?**
ZVI has been used effectively at sites around the world since 1991. A pilot study that was completed at the Depot in April 2004 showed that Zero Valent Iron (ZVI) injection effectively reduced solvents in the groundwater by an average of 95 per cent.

**What happens if it doesn't work?**
A pilot study that was completed at the Depot in April 2004 showed that Zero Valent Iron (ZVI) injection effectively reduced solvents in the groundwater by an average of 95 per cent. Based on those results, and the performance of ZVI at other sites around the world, the BCT is confident that ZVI will work effectively at the Depot. If necessary, additional ZVI injections can be made or other clean-up technologies implemented to augment the ZVI.

USEPA, DLA, and TDEC will review the effectiveness of this remedy at five-year intervals to ensure the site continues to be safe for community reuse.

**Has this remedy already been used in the community?**
ZVI was used November 2004 to January 2005 during an early remedy implementation to treat off-site impacts of solvents in groundwater beneath Memphis, Light, Gas and Water (MLGW) property northwest of Dunn Field. Sampling in January and March 2005 indicated that concentrations of solvents have been reduced by 50 per cent.

Groundwater monitoring will continue and the data will be used in the Off Depot Groundwater Remedial Design to determine if additional ZVI treatments are required to achieve cleanup goals.

**What's the difference between ZVI injection and a PRB?**
ZVI injection involves using pressurized nitrogen to inject ZVI directly into the groundwater through a small number of boreholes drilled through the ground. This allows us to go to specific areas where we know we have high concentrations, and actively treat the groundwater within a radius of approximately 40 feet.

A Permeable Reactive Barrier (PRB) is created by injecting ZVI encased in food-grade gel through a series of boreholes spaced approximately five to 15 feet apart. A PRB several hundred feet long will be installed west of Dunn Field to create a treatment zone that will treat groundwater as the ground water moves naturally through the PRB.

**Will ZVI clean up all of the environmental impacts in this area?**
No, ZVI will be used to clean up CVOCs in the shallow aquifer. Other cleanup remedies such as soil vapor extraction and disposal site excavation will be used to meet cleanup objectives for other areas of the Depot.

The nature and extent of environmental impacts at the Depot, and an assessment of possible risks to human health and the environment, are documented in Remedial Investigation (RI) for the Main Installation and Dunn Field. The Records of Decision (ROD) for Dunn Field provides a complete analysis of the remedies chosen for the Depot and the contaminants to be addressed in the cleanup.

A pilot study that was completed at the Depot in April 2004 showed that Zero Valent Iron (ZVI) injection effectively reduced solvents in the groundwater by an average of 95 per cent. The remaining low concentrations of solvents will be treated through monitored natural attenuation with long-term monitoring to ensure that these remedies are effective.

**Can ZVI get into the drinking water?**
ZVI will be used at the Depot to treat groundwater in the shallow aquifer, which is located 80-100 feet below the ground surface. ZVI will not impact the City's drinking water, which comes from the Memphis Sand aquifer located approximately 250 feet below the surface in the Dunn Field area. Once ZVI is in the ground, the iron particles will bind with the soil and return to its normal state through a natural process called oxidation.

**How long will it take before the groundwater is clean?**

Levels of chlorinated volatile organic compounds in the ground water are expected to reach the Safe Drinking Water Act requirements by 2019.

We plan to have all groundwater remedies in place by 2008. Groundwater treatment will take a number of years and long-term monitoring of groundwater will be performed to judge the effectiveness of the remedies. USEPA and TDEC will review the effectiveness of this remedy at five-year intervals to ensure the site continues to be safe for community reuse.

**How long will that iron stay in the ground? Could it move off site and into the community?**
ZVI is considered a safe substance that presents no unacceptable risks to human health or the environment.

The pilot study we conducted demonstrated that ZVI continues to treat contaminated groundwater that flows into the injection area for an estimated 12 to 18 months after injection. Once ZVI is in the ground, the iron particles will bind with the soil and eventually break down through a natural process called oxidation.

The iron in the PRB is expected to be effective for a longer period of time (at least 10 years). In addition, the iron will be no closer to the ground surface than about 70 feet. Once in place it does not move and will not get into the community.

**What are you going to do to reduce the noise during your work on Dunn Field?**
The Depot's environmental contractors will make every effort to minimize disruption to the community during the cleanup activities. More information about these efforts will be included in the remaining Remedial Designs that will be completed for the cleanup remedies at Dunn Field.

**I read a story in the Commercial Appeal about enhanced bioremediation. Is that the same as ZVI?**
No, they are two different cleanup technologies that have been approved for use at the Depot.

Enhanced bioremediation is one of the technologies approved as a remedy for groundwater at the Main Installation. It involves injecting nutrients that feed organisms already in the environment. These organisms help to naturally break down or degrade certain chemicals. By encouraging the growth of these organisms, we can effectively speed up this process, which is known as enhanced bioremediation.

ZVI is a food-grade powdered iron product that has been used to treat groundwater impacted by CVOCs since the early 1990s. USEPA considers it to be a safe substance that presents no unacceptable risks to human health or the environment.

## EXCAVATION, TRANSPORT AND DISPOSAL (ET&D)

**What is ET&D and where is it being used?**
Excavation, Transport and Disposal (ET&D) is the remedy approved in the Dunn Field Record of Decision (ROD) for the disposal sites area on Dunn Field. Work began in March 2005 to remove buried waste and affected soil from five disposal sites. The first phase was completed in May and the second phase will be completed in July/August 2005.

The excavated soil will be sampled to ensure waste is taken to the appropriate facility for disposal. Non-hazardous waste will be transported to the Browning Ferris Industries (BFI) South Shelby landfill. Soil and debris that are classified as hazardous waste will be transported to the Emelle Treatment Facility in Emelle, Alabama. Excavated soil is being replaced with clean fill at each disposal site.

Following excavation, the environmental contractors will collect soil samples from each disposal site to confirm that cleanup goals have been met. During ET&D activities, the environmental contractors are following a site safety plan to protect workers, residents and the environment. The plan includes air monitoring, dust control measures, equipment cleaning, and personal protective equipment for workers.

**What kinds of materials were in the disposal sites?**
Materials excavated from the disposal sites include discarded, empty drums, construction debris, metal and glass. Site 3 had numerous 1-quart bottles with clear liquid. Tests indicate the liquid contained acidified water with ortho-toluidine hydrochloride, a compound used to test water for the presence of chlorine.

**Was the community notified that this activity would be taking place?**
Excavation, transportation and disposal (ET&D) was selected as the remedy for the disposal sites in the Dunn Field Record of Decision (ROD), which was approved in April 2004. The Disposal Sites Remedial Design was distributed to the Restoration Advisory Board (RAB) in June 2004. A public briefing on the Remedial Design for the remedy was held in January 2005.

## ENHANCED BIOREMEDIATION TREATMENT (EBT)

**What is EBT?**
Scientists have discovered there are naturally occurring organisms present in the environment that can help to break down chlorinated solvents in groundwater, and turn them into safe, natural compounds. This process is known as bioremediation.

Enhanced bioremediation involves injecting natural nutrients into the groundwater as an additional food source for these tiny organisms. This speeds up the natural process by encouraging the growth and development of more organisms. EBT has been used successfully at hundreds of cleanup sites across the country.

**How do you know it will work at the Depot?**
EBT has been used effectively at sites around the world. During a year-long pilot study completed in 2003, the Depot's environmental team set up two test sites where organic nutrients were injected into the groundwater. Vegetable oil was used at one site and sodium lactate was used at the other, to compare the effectiveness of the substances. The results of the study showed that multiple injections of sodium lactate will be the most effective solution for treating solvents in the shallow aquifer beneath the Main Installation (MI).

Additional monitoring wells will also be installed to ensure the effectiveness of the treatment. USEPA and TDEC will review the effectiveness of the cleanup remedy at five-year intervals to ensure the site continues to be safe for community reuse.

**Where will it be used at the Depot?**
EBT was selected as the remedy for groundwater at the Main Installation. During the winter of 2005/06, EBT will be implemented in two areas of the MI where concentrations of solvents are the highest. In the southwest corner of the MI, 16 injection wells will be used to introduce sodium lactate into the groundwater. In the southeast corner, nine injection wells will be used. Injections will occur bi-weekly during the first year of treatment and then reduce to a monthly schedule until the cleanup goals are reached.

Additional monitoring wells will also be installed to ensure the effectiveness of the treatment. USEPA and TDEC will review the effectiveness of the cleanup remedy at five-year intervals to ensure the site continues to be safe for community reuse.

**Is EBT safe?**
Bioremediation is very safe because it relies on microbes that naturally occur in soil. These microbes are helpful and pose no threat to people at the site or in the community. The nutrient that will be added to make the microbes grow is a natural substance, sodium lactate.

Once cleanup targets have been met, the nutrients will no longer be added, and the condition of the microbes will return to its natural state.

The Record of Decision (ROD) for the Main Installation provides a complete analysis of the selected remedies. Each remedy and technology was thoroughly evaluated for safety and efficacy.

**Will EBT affect the drinking water?**
No. The affected groundwater is in the shallow aquifer known as the fluvial aquifer. This aquifer is about 90 feet below the ground surface. This water is not used for drinking water, so there is no exposure to the community. The city's drinking water is drawn from the Memphis Sand aquifer, located roughly 250 feet below the ground surface.

**How can I find out more about EBT?**
More information on EBT is also available on USEPA's website at **http://www.epa.gov/swertio1/download/citizens/bioremediation.pdf**.

## MONITORED NATURAL ATTENUATION (MNA)

**What is Monitored Natural Attenuation (MNA)?**
Natural attenuation relies on natural processes to clean up or *attenuate* pollution in soil and groundwater. Scientists monitor or test these conditions to make sure natural attenuation is effective at a particular site. This is called *monitored natural attenuation* or *MNA*.

MNA may reduce compounds in several ways: breaking them down into individual components through biodegradation; reducing their concentration through dilution, dispersion or evaporation; or binding them to soil through adsorption so that the compounds do not spread or migrate off site.

**How is MNA being used at the Depot?**
MNA is part of the approved remedy for groundwater at the Main Installation and will be used to treat groundwater containing low levels of solvents or volatile organic compounds (VOCs), in the shallow aquifer beneath the MI and for a limited area west of Dunn Field. MNA will complement the ZVI and Enhanced Bioremediation Treatment (EBT) that will be implemented in areas where the shallow aquifer has higher concentrations of VOCs.

The Depot will implement long-term groundwater monitoring to document changes in concentrations and to ensure compounds do not migrate off-site or into deeper aquifers.

**How do you know it will work?**
MNA has been used successfully at cleanup sites around the world and has been found to work just as well and almost as fast as other cleanup methods. It works best when the source of pollution has been removed or remediated using an active treatment.

The Record of Decision (ROD) for the Main Installation provides a complete analysis of Monitored Natural Attenuation as part of the selected remedy for groundwater. It was thoroughly evaluated for safety and efficacy.

USEPA, DLA, and TDEC will review the effectiveness of this remedy at five-year intervals to ensure the site continues to be safe for community reuse.

**How can I find out more about MNA?**
More information can be found in the USEPA's *A Citizen's Guide to Monitored Natural Attenuation*, located online at http://www.clu-in.org/download/citizens/mna.pdf.